

Appendix E – Draft Unionid Mussel Translocation Plan

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DRAFT UNIONID MUSSEL TRANSLOCATION PLAN -**CB&I Barge Terminal at Tennessee River mile 424, Marion Co., TN****Prepared by: TVA Natural Heritage Program****Introduction**

Chicago Bridge & Iron, Inc. (CB&I) has plans to construct a metal fabrication facility with a barge terminal on the left (descending) bank of the Tennessee River about one-half mile downstream of Nickajack Dam (= Guntersville Reservoir near river mile 424; Marion County, TN; Figures 1-3). One storm water outfall is expected to empty into the Tennessee River, and two storm water outfalls are expected to empty into Graham Branch, a tributary to the Tennessee River on the western boundary of the property (Figure 4). The Tennessee Valley Authority (TVA) has jurisdictional oversight of development at the proposed site and must issue a Section 26a permit for development to occur. The U.S. Army Corps of Engineers (Nashville District; USACE) must also permit (Section 404 and Section 10) activities at the proposed site, but TVA is the agreed upon lead agency regarding environmental review and consultation with the U.S. Fish and Wildlife Service (USFWS) of this project. The barge terminal will support delivery of products from a proposed metal fabrication facility onsite. The plans show a property waterfront length of about 225 meters (m) or 730 feet (ft). The proposal includes construction of a cement launching ramp, a crane platform, a dock supported by sheet piling and back-fill, and bank stabilization using rip-rap. Direct instream impacts (project footprint) will extend to approximately 30m (~ 90ft) off of the left bank and 110m (~ 350ft) along the property's waterfront (see Figure 3).

The TVA Natural Heritage Database indicated that the federally endangered (FE) pink mucket (*Lampsilis abrupta*) and Anthony's riversnail (*Atheamnia anthonyi*) inhabit this portion of the Tennessee River. Thus, TVA requested CB&I conduct a survey of unionid mussels, snails, and habitat in the area of the proposed barge facility to determine if listed species were present in areas affected by construction and operation of the facility. A survey of mussels and habitat in an area extending 50m upstream to 200m downstream of the project area and from the left bank to 70m toward the river channel was completed in September 2008 (see report in Appendix A). One pink mucket (FE) was collected during the survey. Some key findings are listed below, and a full report (Lewis Environmental Consulting, 2008) of the survey is presented in Appendix A. Since the proposed project area supports pink mucket, TVA has developed a mussel translocation plan (described below) as a conservation measure to minimize potential harmful effects by the proposed action. This mussel translocation plan will be included in a

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Biological Assessment being prepared for this project. A survey of snails and habitat in the same study area was completed in October 2008 (see report in Appendix B; Pennington & Associates, 2008). A total of 225 live snails representing seven species were collected; however, no evidence of Anthony's riversnail or any other federal-listed snail species was found (Table 1; also see Appendix B). Therefore, TVA is not proposing any conservation measures to minimize impacts to snails by the proposed action.

Mussel Community Characteristics at the Proposed Barge Facility Site

A comprehensive report of the mussel survey (Lewis Environmental Consulting, 2008) is presented in Appendix A. In addition to the report, Figure 5 depicts the distribution of unionid mussel densities per sample by sample type (quantitative and semi-quantitative) in relation to the instream project footprint. Figure 6 depicts the distribution of riverbed substrate composition and depths within the survey area. A total of 920 live mussels representing 16 species were collected during the survey. Semi-quantitative sampling efforts collected 795 mussels representing 13 species, including one pink mucket found 5-10m off the bank near the downstream margin of the project footprint (see Figure 5). Thus, pink mucket comprised an estimated 0.11% of the unionid community in this area (based on quantitative and semi-quantitative data combined). Mussel density per semi-quantitative sample ranged 0 – 3.8 mussels/m² and averaged 0.76 mussels/m². A total of 910 minutes (min) were spent collecting semi-quantitative samples, which translated into a catch-per-unit-effort (CPUE) of 0.87 mussels/min or 52.4 mussels/hr. For quantitative samples, a total of 125 live mussels representing 11 species were collected; densities ranged 0–20 mussels/m² and averaged 4.76 (± 1.00 2SE) mussels/m² per sample. Consequently, if the project footprint is 30m x 110m (or 3,300m²), then an estimated 15,708 ($\pm 3,300$ 2SE) mussels may be affected directly by the proposed project. Additionally, if we assume that pink mucket comprises 0.11% of the community, then an estimated 17.3 (± 3.63 2SE) individuals could be present within the construction footprint and could be affected directly by the proposed project.

Mussel Translocation and Monitoring

Collection Area

The Collection Area will be delineated around the proposed construction footprint with a small buffer area along the upstream, downstream, and riverward boundaries of the footprint. Thus, the Collection Area will extend from approximately 5m off of the bank to 35m off of the bank (at normal pool level; = 30m wide) and extend 130m longitudinally (upstream – downstream

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direction) from approximately Transect 06 to Transect 03b (= 3,900m²; Figure 7). We recommend delineating the Collection Area into more manageable search cells. Within each search cell, two search options are offered for review by the natural resources agencies (USFWS and TWRA); however, only one search option will be presented in the final Biological Assessment. The search options attempt to ensure thorough spatial coverage and provide enough effort (time) to effectively collect most of the mussels inhabiting the Collection Area while limiting the effort to stay within a reasonable cost.

- 1) Search Option 1 will use a "working line" strung between two "anchor lines" spaced 5 m apart, which form the sides of each 5m wide x 10m long search cell (see Figure 7). Each anchor line will have a loop at 1m intervals along its length where the working line will attach. A diver will search for mussels along the working line within a 1m-wide path from one anchor line to the other. The diver will search visually and tactually (by waving his hands through the top 5cm [\sim 2in] of the substrate to detect buried mussels). Upon reaching the opposite anchor line, the diver will move the working line upstream 1m to the next loop on the anchor line and continue the search in the opposite direction. This search method will continue in a zig-zag pattern until the diver reaches the 10m endpoint of the anchor lines. If the diver sets a target search rate of 1-2min per length of working line (= 5m²), then the effort spent by the diver in a search cell is approximately 20 - 40min. A second (different) diver will search the cell again in the same fashion, resulting in a total target effort of 40 - 80min per search cell. A search efficiency rate of 80% will be used to ensure thorough collection in each cell. For example, if the second diver collects mussels totaling less than 20% of the mussels collected during the first search, then the collection effort for that cell is complete. If the second diver collects mussels totaling more than 20% of the first search, then a third search of the cell will be conducted. If each search cell is limited to two searches (40 - 80min), then the search effort spent in the entire Collection Area (78 cells) will be 52 - 104hr.
- 2) Search Option 2 provides a finer-scale search effort and a threshold for determining where excavation of the riverbed substrate would occur to increase the likelihood of collecting mussels (particularly pink mucket) buried beneath the substrate surface. Like Search Option 1, two "anchor lines" spaced 5m apart would be secured to the riverbed in a generally parallel orientation with the shoreline to mark the sides of each search cell. Starting at the downstream boundary of the Collection Area, a 1m x 5m grid (e.g., made

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of PVC) divided into five 1m x 1m search cells would extend between the two anchor lines. A diver would search each cell using visual and tactual (top 5cm of substrate) search methods to collect mussels near the substrate surface. A target search rate of 0.5 - 1min per cell would be used to limit searches. Each cell would be searched by two different divers. Therefore, a total search effort of the substrate surface in the Collection Area (3,900m²) at the proposed search rate would be approximately 65-130 hr.

Since the initial survey in September 2008 found the majority of mussels were buried beneath the substrate surface (based on comparison of semi-quantitative vs. quantitative sampling data; see Figure 5), it seems appropriate to excavate areas (cells) with relatively high surface-density of mussels to increase the probability of detecting pink mucket. If the total mussels collected within a cell exceeded some agreed upon density threshold (e.g., 2 mussels/m²), then all material in that cell would be excavated to a depth of 10 - 15cm and processed (i.e., 3mm-mesh sieve). The amount of area requiring excavation is difficult to estimate, but mussel densities (semi-quantitative samples) within the project footprint appear to be relatively low to moderate (0.1 - 2.5 mussels/m²; see Figure 5) compared to the entire study area. The proportion of mussels at the surface and those found buried in excavated cells will be recorded.

Mussel Processing and Handling

A qualified/permitted malacologist will identify and count all live mussels collected. Length (mm), height (mm), age (estimated by counting external shell annuli), sex (if sexually dimorphic species), and digital image (with size reference) will be recorded for all individuals of federal-listed species collected. All federal-listed mussels will be marked with a unique identification number (e.g., using tags glued to the shell surface or by engraving with a Dremel™ tool). Additionally, a line will be engraved perpendicular to the shell growth rings at the shell margin to provide a reference of size at the time of collection for use in future growth measurements to assess mussel health. Since few federal-listed mussels are expected to be collected, efforts to monitor impacts of the translocation on these individuals may be hampered by low recapture rates. If the USFWS and TWRA wish to use common species as surrogates for assessing impacts from translocation on pink mucket, then individuals of the three most common species (pink heelsplitter [40.0%], pimpleback [22.0%], and washboard [14.4%]; see Appendix A) occurring in the 2008 survey area will be used; a minimum of 50 individuals of each surrogate species will be measured (length and height in mm), marked with a unique identification

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number, and engraved with a size reference mark at the shell margin like that described above for pink mucket.

All live mussels will be held in mesh-collection bags suspended in flowing river water at all times except during processing or translocation. During processing and translocation, mussels will be kept wet and cool, and out-of-water time will be minimized (1 - 5min). If translocation requires movement over a significant distance, mussels may be held in containers (*i.e.*, live wells) with aerated river water held at ambient river temperatures. All mussel handling activities associated with the translocation will be restricted to periods when water temperatures are above 10°C (= 50°F) and air temperatures are above freezing since mussels are generally inactive below these temperatures and could experience significant stress leading to mortality due to handling. Based on historical temperature data for the Nickajack Dam tailwater, these temperature thresholds are typically restricted to the period between mid-December to mid-March (see Figure 8). Additionally, the USFWS and TWRA has also set a maximum allowable time period of 6 months between the time of a translocation and the start of construction to avoid impacts to listed mussels that may recolonize the project footprint.

Zebra mussel infestation rates (*e.g.*, percentage of shell covered or abundance) will be noted for live unionid mussels. Dead unionids (shells only) will be identified and scored as either freshly dead (with or without soft tissues, nacre lustrous, valves typically intact, periostracum present; animal likely dead less than one year), weathered dead (no soft tissues, nacre very dull or chalky, valves may or may not be intact, periostracum worn; animal probably dead more than one year), or fragment (portion of a shell and/or extremely worn and chalky, valves not intact, little or no periostracum; animal dead from many years to many decades). Only freshly dead shells will be quantified to provide an estimate of recent mortality of native mussels at the time of the study.

Translocation Area

A Translocation Area will be chosen using recommendations from the U.S. Fish and Wildlife Service (USFWS) and Tennessee Wildlife Resources Agency (TWRA). An ideal translocation area will strive to meet the following conditions:

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1. Located near the Collection Area in the same river with similar or generally improved habitat conditions (e.g., substrate composition, depth, flow, water chemistry, and potential host fish community) relative to those in the Collection Area.
2. Currently supports a native unionid mussel community with the same or similar species composition as the Collection Area, including pink mucket.
3. Occurs beyond potential deleterious impacts from the proposed project, as well as other sources of known or foreseeable hazards to mussel health, survival, and reproduction.
4. Large enough to support the addition of translocated mussels without harming the mussels currently inhabiting the translocation area (e.g., such that an increase in density of the native community does not exceed 25%).

Selection of the Translocation Area will be guided by the USFWS and TWRA, but the site may need to be surveyed prior to collection of mussels from the Collection Area to determine its suitability. Once an acceptable location is found, the Translocation Area will be delineated and GPS coordinates of its boundaries will be recorded. A portion of the Translocation Area will be designated as a location for a Monitoring Area where federal-listed mussel species (and surrogate marked mussels if deemed necessary) will be placed. Starting at the downstream boundary of the Monitoring Area, a removable 1m x 5m monitoring grid (e.g., made of PVC) forming a row of five 1m x 1m cells will be used to guide the placement of translocated federal-listed (and surrogate) mussels so they can be located during future monitoring efforts and to avoid overcrowding of native mussels. Additional monitoring grid cells will be added as necessary to accommodate mussels that will be monitored. For example, if the native mussel density in the Translocation Area is 8 mussels/m² and 160 mussels (e.g., 10 pink mucket and 50 individuals each of three common species) are used for monitoring evaluation, then two translocated mussels will be hand placed into each 1m x 1m cell (= 25% of native density), except for one random cell in each row that will be omitted and used as a control (reference) cell. Therefore, 80 cells within 20 rows of 5 cells each will make up the Monitoring Area. The remaining translocated mussels will be more-or-less evenly distributed within the General Translocation Area that is large enough to accommodate transplanted mussels and not increase the native density by more than 25%. The corners of the Monitoring Area and the General Translocation Area will be marked with pieces of rebar driven into the riverbed, and GPS coordinates of those locations will be recorded using a GPS unit with sub-meter accuracy (located on a boat positioned directly above these locations).

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Monitoring Plan

Future monitoring of the survival and health of pink mucket (and surrogate species) will include:

1. A non-invasive assessment of survival within the grids within 4-6 weeks (wk) after translocation. The effort will include detection of freshly dead specimens of translocated mussels. All dead unionid shell material on the substrate surface will be collected and assessed, including shells of native mussels for comparison of potential differences in mortality between translocated mussels and native mussels. If significant mortality is detected, then additional assessment within the Monitoring Grids or the General Translocation Area may be required after discussion with the USFWS, TWRA, TVA, and USACE. Water quality conditions will be measured, and any habitat changes or visible threats will be recorded.
2. At one year and two years after translocation, all mussels (federal-listed, surrogate species - if used, and native mussels) within the Monitoring Grids will be collected and assessed (measurement of length, height, shell growth, and general health [e.g., valves closed tightly or agape]), and returned by hand to the location from which they were collected. Water quality and habitat conditions will be measured to help detect any potential impacts to the translocated mussels other than handling during translocation and monitoring efforts.

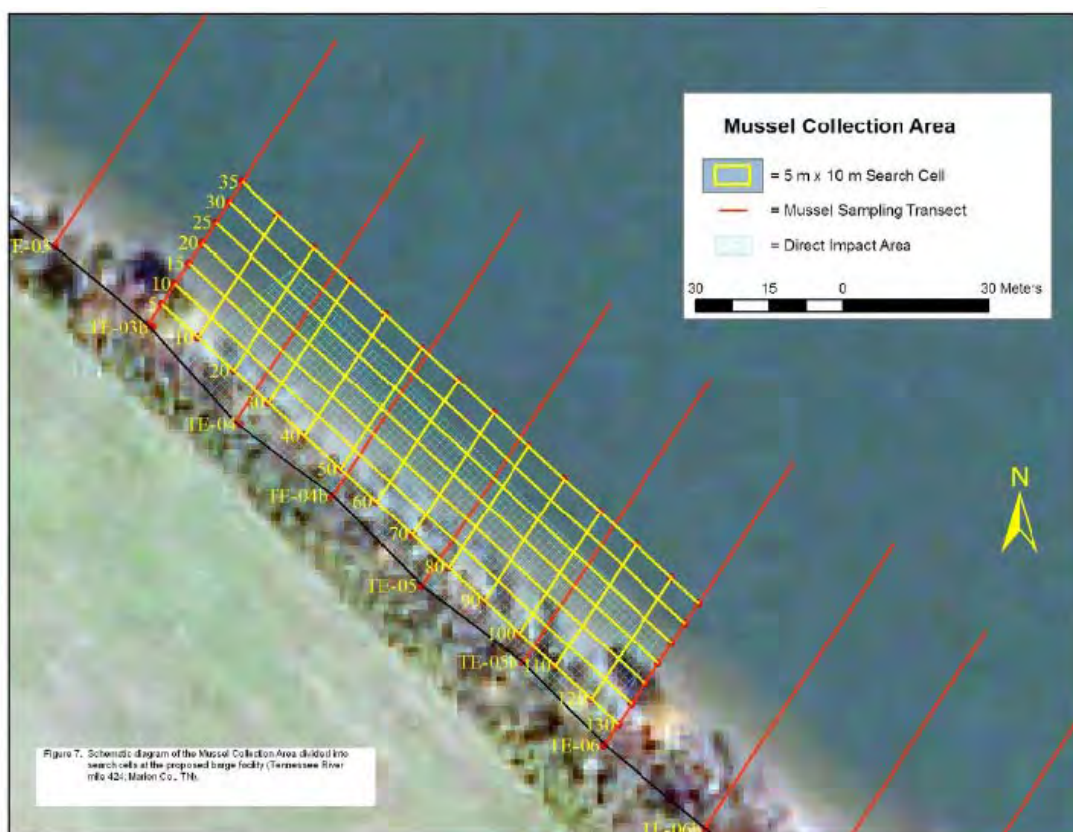
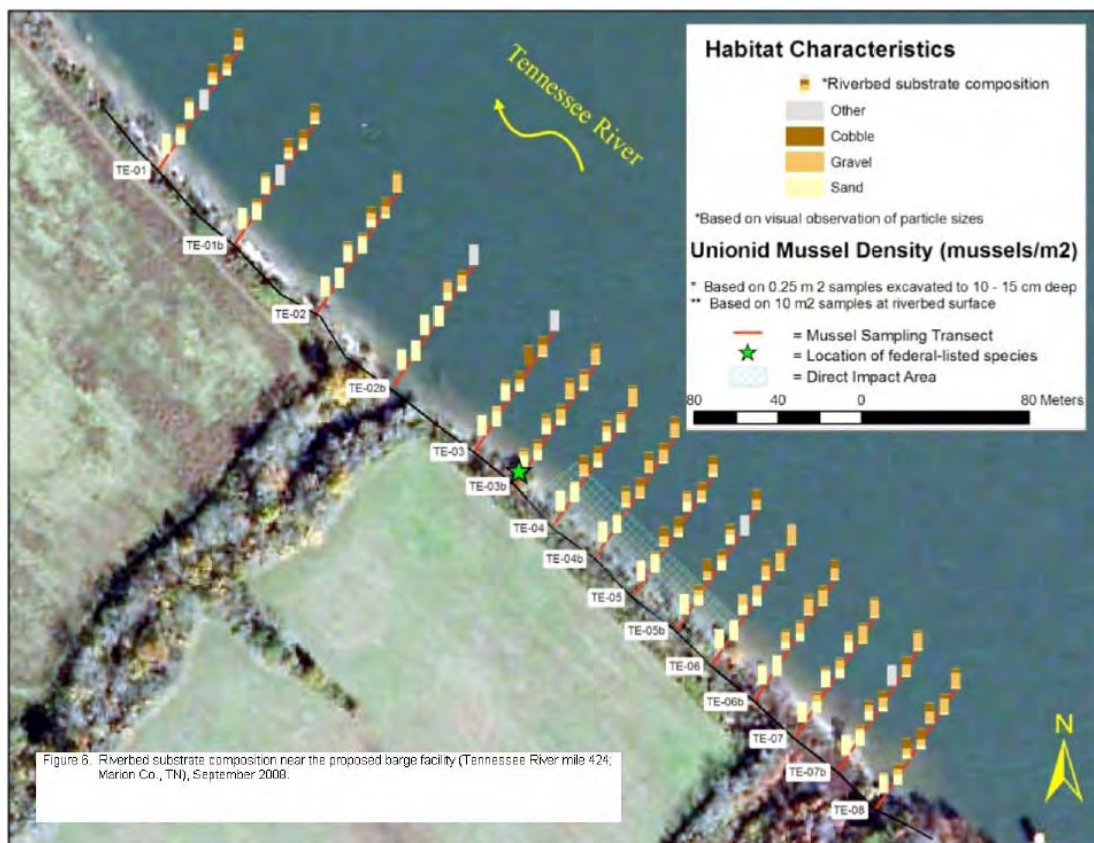
Reporting

A full report will be prepared after the translocation and due within one week following the 4 - 6wk assessment of mussels in the Monitoring Grid. The report will include: a description and GIS-based map(s) of the original survey area, the Collection Area, and Translocation Area; a detailed description of the methods used; characterization of the mussel community moved from the Collection Area and existing within the Translocation Area; tables indicating the disposition (Monitoring Grid cells) of each translocated mussel being monitored (*i.e.*, federal-listed and surrogate species); habitat characteristics of each area; all raw data, GPS coordinates, and digital images (Collection Area, Translocation Area, and all federal-listed species) presented in appendices; and the presentation of any other pertinent or summarized data helpful in understanding and managing the affected mussel resources. A copy of all electronic files (*e.g.*, database in Excel format, report in Word format, maps in GIS format; entire report compiled into PDF format) will be provided to each agency stakeholder (USFWS, TWRA, TVA, USACE) on

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compact disc(s) upon completion of the report. Summary reports of the 1-year and 2-year monitoring efforts will be submitted to each agency within 30 days of completion of the monitoring efforts.





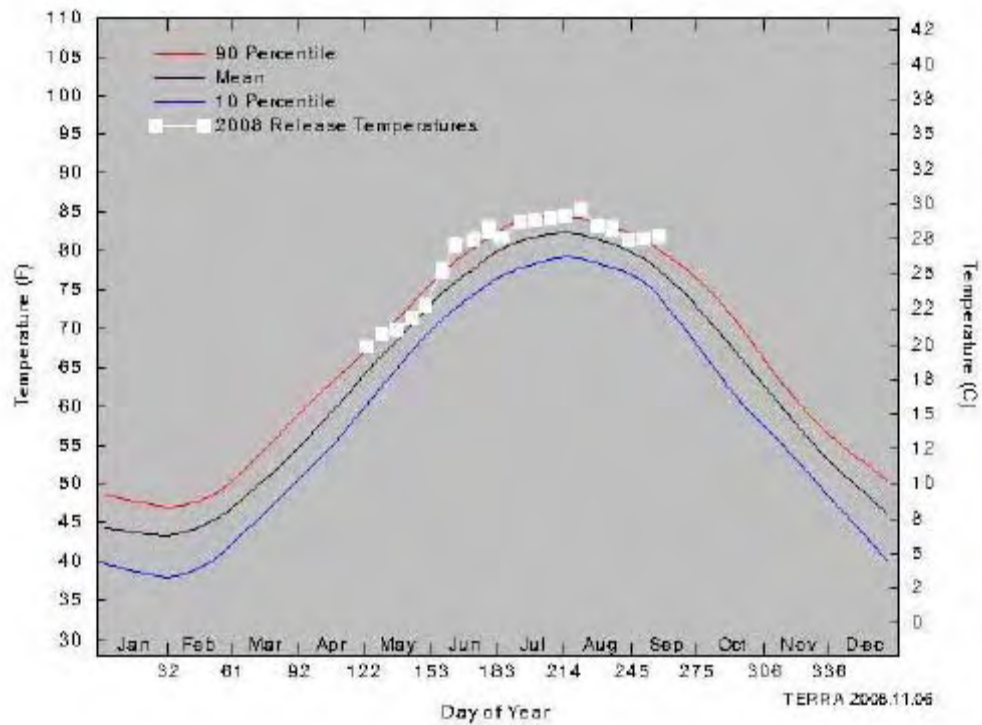


Figure 8. Historical mean daily water temperature plots of the Tennessee River in the Nickajack Dam tailwater.

Table 1. Status, abundance, and frequency of aquatic snails collected near Tennessee River mile 424, October 2008¹.

Species	Common Name	Status ²	Abundance per Condition		Relative Abundance ³ (%)
			Live	Relic	
<i>Campeloma decisum</i>	pointed campeloma	-	27	33	12.0
<i>Elimia laqueata</i>	panel elimia	-	3	31	1.3
<i>Lithasia verrucosa</i>	varicose rocksnail	-	2	9	0.9
<i>Pleurocera canaliculata</i>	silty hornsnail	-	131	286	58.2
<i>Pleurocera corpulenta</i>	corpulent hornsnail	S1	2	1	0.9
<i>Pleurocera nobile</i>	noble hornsnail	-	2	3	0.9
<i>Viviparus sp.</i>	-	-	58	34	25.8
Total			225	397	100.00

¹ data summarized from Pennington & Associates, 2008; see Appendix B² S1 = Critically Imperiled in Tennessee³ based on live individuals only

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